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THIRD MONTHLY PROGRESS REPORT

MAY 1964

MICRODENSITOMETER CAPABILITY AND INTERPRETATION STUDY

This report covers the third month's activities on a program of studies of microdensitometer capability and interpretation techniques. The program has three objectives, which are: (1) the establishment of techniques which will enable a microdensitometer operator to use the instrument to its maximum capability and to interpret the data therefrom accurately, (2) a survey of existing instruments to study the most recent developments in microdensitometry; and (3) a study of the feasibility and effectiveness of various advances in the state-of-the-art.

Each of the three tasks has been continued during the reporting period. As of the end of the month, the percentage expenditure to date was 35%.

I. Mensuration Procedures and Data Interpretation

The primary emphasis on Task I has been on the application of microdensitometry to photographic system performance analysis, light source coherence effects, and grain scattering effects on density determination. A compilation has been made of measurable image quality parameters which are affected by various photographic system performance characteristics. Procedures for determining various image quality parameters are known; therefore, cause-and-effect relationships between system performance and image quality are being derived which will provide procedures for system performance analysis. One example of a system performance characteristic which can be evaluated in this manner is image motion.

As a result of a theoretical analysis which indicated that the value of the resolution obtained from the maximum of the slope of an edge trace is not a good measure of image motion, photographs are being produced with different amounts

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of image motion introduced synthetically. These will be scanned on the microdensitometer to evaluate techniques for determining image motion from edge traces.

The computer program investigation of the influences of the degree of coherence of the illuminating light upon images of rectangular objects has been completed and the results are currently being analyzed. The computer program also includes computations which determine the influence of the width of the analytical aperture. The influence of the size of the illuminating aperture is being investigated. Preliminary calculations show that the sharpness of the image of an edge can be improved by employing an illuminating slit whose width is comparable to the line spread of the illuminating system.

The investigation of the dependence of measured density on source and detector specularity has been continued. The tests outlined in the previous report were completed and graphs of density as a function of specularity were plotted. For each of the films studied, diffuse densities will also be determined. A memo describing these results will be prepared during the coming month.

II. Equipment Capability

The survey of microdensitometer manufacturers has been completed. The results of the survey are shown in Table I. Approximately eight of the manufacturers queried do produce instruments which can be classified as microdensitometers. A series of tests has been developed to evaluate these instruments and is being checked by being used to evaluate our [redacted] Model 4 microdensitometer. The microdensitometer manufacturers will be contacted, and a schedule will be set up for evaluating their instruments.

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III. Feasibility Studies

The primary effort on Task III for this reporting period was the completion of the edge trace analysis and generation of suitable sine-wave tests charts.

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1. Optical alignment error in the microdensitometer at [redacted]
2. Differences in quality between the edges used

Reasons for this difference will be determined and reported.

It was determined that the modulation for the sine wave patterns could be determined by taking the ratio of the intensities of the diffracted and undiffracted light in the optical Fourier transform.

By scanning the optical Fourier transform intensity pattern of the 100, 200, and 400 cycles/mm chart, the modulation for each pattern has been determined. The values obtained are 30% for the 100, 46% for the 200, and 45% for the 400 cycles/mm charts.

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